PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES

AT UNCONTROLLED HAZARDOUS WASTE SITES (REM II)

U.S.EPA CONTRACT NO. 68-01-6939

ADDENDUM TO

FINAL SAMPLING AND ANALYSIS PLAN

FOR

SECOND QUARTER OF SAMPLING FOR THE

REMEDIAL INVESTIGATION

FOR

ORDOT LANDFILL, GUAM

EPA WORK ASSIGNMENT NO. 168-9LA7.0

REM II DOCUMENT CONTROL NO. 279-RI1-OP-EQVX-1

Prepared by: James A. Goodrich 6-8-87
James A. Goodrich, C.E.G. Date
Site Manager

Approved by: Michael C. Richards _____
Michael C. Richards Date
Regional Manager

Approved by: Sara R. Black 6/9/87
Sara R. Black, Peer Reviewer, Region IX - Date
Technical Review Committee

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 9
TOXICS & WASTE MANAGEMENT DIVISION
FIELD OPERATIONS BRANCH

Sample Plan Title: Addendum to Final Phase I Remdial Investigation SAP

Site Name: Ordot Landfill

Site Location: Guam

City/State/Zip: Ordot, Guam 96910

Site EPA ID #: GUD - 980 - 637 - 649

Anticipated Sampling Dates: July 20 - 24, 1987

Prepared by: Kevin E. Kelly/James A. Goodrich — June 8, 1987 (Date)

Agency: Camp Dresser & McKee

Address: 2302 Martin St., Suite 275

City/State/Zip: Irvine, CA 92715

Telephone: (415) 495-5009, (714) 752-5452

EPA Project Officer: Marvin Young — (415) 974-8444 (Phone #)

QAPP Approval Date: March 6, 1987

* * * * * * * * * * * * *

FOR

Received by Field Operations Branch: _____ Date

Received by Reviewer: _____ Date

Reviewed by: _____ Date

EPA

Concurrence: _____ Date
Chief, Field Operations Section
Toxics & Waste Management Division

Received by Quality Assurance Management Section: _____ Date

USE

Analysis Reserved by: _____ Date
Laboratory Support Section
Environmental Services Branch, OPM

* * * * * * * * * * * * *

US07811

PART I - SITE HISTORY AND BACKGROUND

The Ordot landfill receives the majority of the wastes generated on the island and was designed and operated as a municipal landfill. However, the landfill is known to have received hazardous wastes during its history, which dates back to the Japanese occupation during World War II. The site is known to have received PCB contaminated oils from transformers, munitions, and hazardous wastes commonly used in households and light industry. However, records do not exist regarding when, how much, and what type of hazardous wastes were disposed of at the landfill.

Uncontrolled disposal of hazardous and other wastes at the Ordot Landfill has resulted in several problems, including uncontrolled surface water run-on and run-off from the site. The uncontrolled surface water run-on, including a large spring which runs into and across the landfill, has resulted in leachate emanating from various locations around the landfill. This leachate leaves the landfill site in the form of small springs or streams and eventually enters a stagnant pond or the Lonfit River (Figure 1). The leachate that discharges to the river eventually enters Pago Bay on the east side of the island, where fish kills have been reported. Contamination of marine life and recreational areas in Pago Bay are potential public health problems, therefore, it is proposed that leachate and surface water sampling be conducted near the site.

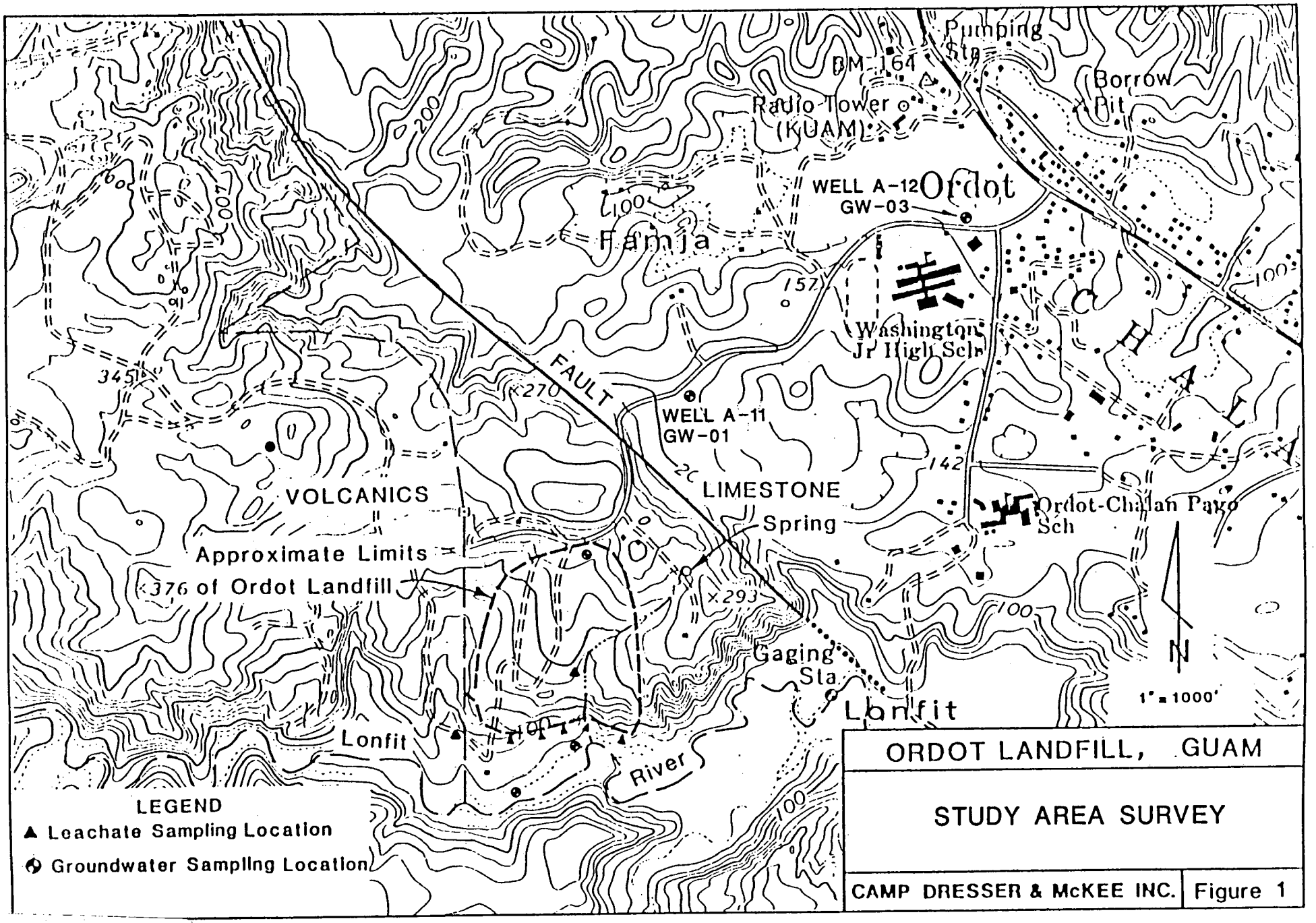
An additional possible public health problem due to the Ordot Landfill is the potential contamination of the limestone, sole-source aquifer in the area. The landfill is located in the general vicinity of the limestone unit, and, as such, there is some concern that there is a potential for contaminating the limestone aquifer. There is also some concern that

leachate from the landfill is contaminating the alluvium along the Lonfit River, in which case there would be a potential for contaminants to discharge to the Lonfit River.

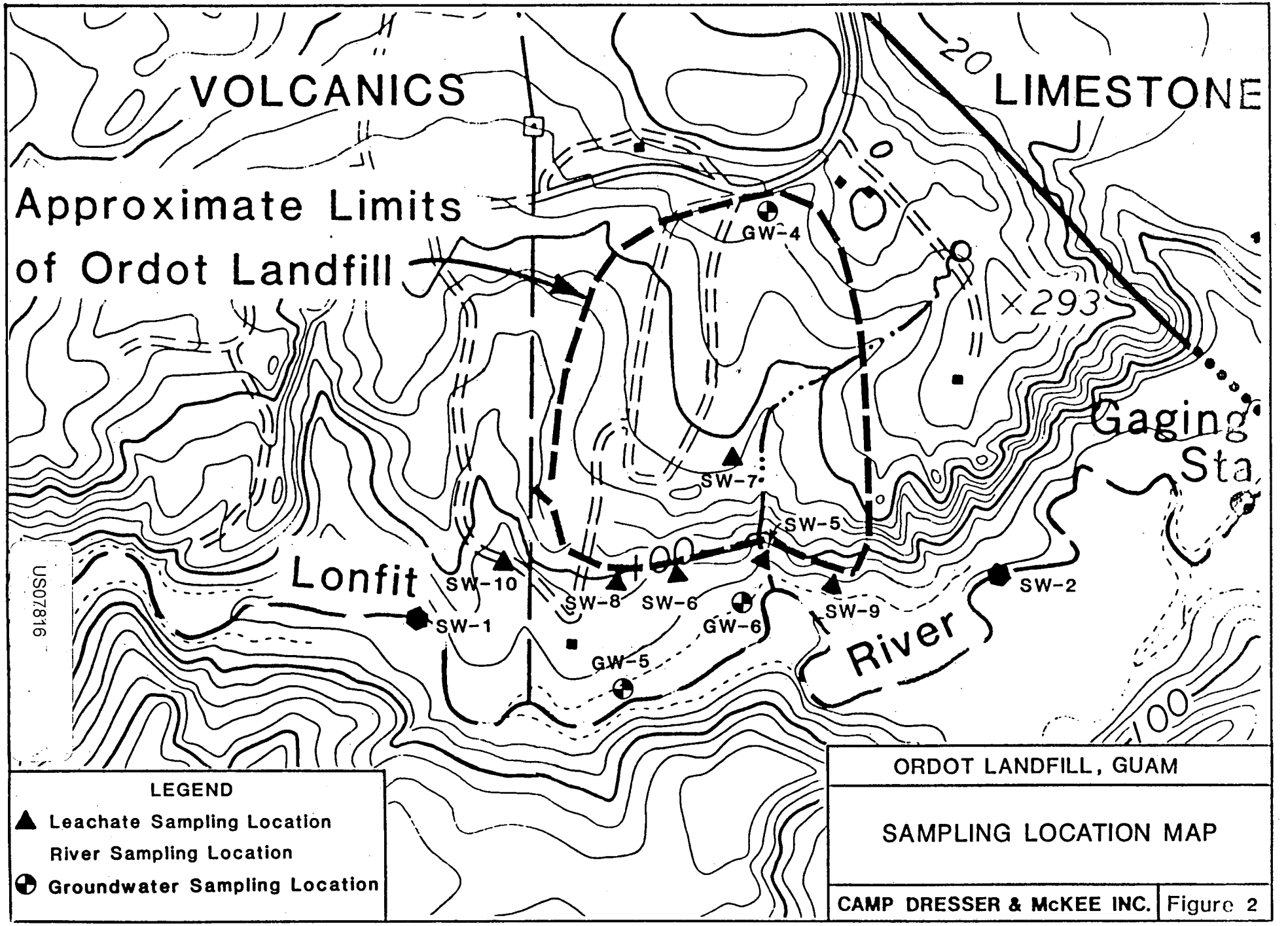
Camp Dresser & McKee Inc. submitted a Sampling and Analysis Plan (SAP) for the initial sampling round in February, 1987. The SAP was approved by U.S. EPA on February 9, 1987 and site characterization was initiated in March 1987. This characterization included leachate, groundwater, and surface water sampling. The samples were analyzed by the Contract Laboratory Program (CLP) for Target Compound List (TCL) volatiles, semi-volatiles, metals, and pesticides/PCBs. In addition, a limited air reconnaissance of the landfill was conducted with portable field instruments. The majority of the analytical results are still undergoing data validation.

The sampling conducted in March, 1987 was intended to be the initial quarterly sampling effort. Due to the heavy rainfalls expected during the summer and fall, seasonal variations in leachate emission and water quality may be very significant. In order to define this seasonality, quarterly sampling is recommended. The sampling effort proposed in July, 1987 will represent the second quarterly effort and assist in the characterization of the seasonal variations expected to occur at the site.

PART II - FIGURES


Pumping Sta
DM-164
Borrow Pit
Radio Tower (KUAM)
WELL A-12
GW-03
Ordot
Famja
Washington Jr High Sch
CHALAN
FAULT
WELL A-11
GW-01
VOLCANICS
LIMESTONE
Spring
Ordot-Chalan Pago Sch
Approximate Limits of Ordot Landfill
Gaging Sta
Lonfit
Lonfit River
N
1" = 1000'
LEGEND
▲ Leachate Sampling Location
Groundwater Sampling Location
ORDOT LANDFILL, GUAM
STUDY AREA SURVEY
CAMP DRESSER & McKEE INC.
Figure 1

US07815


VOLCANICS
LIMESTONE
Approximate Limits
of Ordot Landfill
GW-4
×293
Gaging
Sta
SW-7
SW-5
Lonfit
SW-10
SW-8
SW-6
GW-6
SW-9
SW-2
SW-1
GW-5
River
US07816
LEGEND
Leachate Sampling Location
River Sampling Location
Groundwater Sampling Location
ORDOT LANDFILL, GUAM
SAMPLING LOCATION MAP
CAMP DRESSER & McKEE INC.
Figure 2

PART III - OBJECTIVE OF SAMPLING EFFORT

The primary objective of the second quarter of sampling is to define potential seasonal variations. In addition, the overall project objectives are to determine if contaminants are present at the site, identify specific contaminants, identify contaminant concentrations, quantities, and physical states, as well as establish a water quality data base for the landfill site. In order to meet these objectives, the following activities will be performed at the site:

1. Determine the quality of leachate leaving the boundaries of the landfill;
2. Determine the water quality in the Lonfit River, both upstream and downstream of the landfill;
3. Determine the water quality of the groundwater in the limestone aquifer in the vicinity of the town of Ordot; and
4. Determine groundwater quality in Lonfit River alluvium.

The reconnaissance-level air quality survey and geologic investigation were conducted during the first quarterly sampling round and will not be included in the second round. However, air quality surveying will be conducted for personnel protection, pursuant to the Health and Safety Plan (HSP). The HSP remains unchanged for this round of sampling and is included in Part VII.

PART IV - RATIONALE FOR SAMPLE LOCATIONS, NUMBER OF SAMPLES, AND ANALYTICAL PARAMETERS

In addition to the objectives stated in the approved Final SAP (Document No. 279-RI1-OP-DXFL-1), the rationale for the second quarter of sampling is to (1) define seasonal variations in the leachate, groundwater and surface water quality; and (2) expand the data base to be utilized for identifying the appropriate remediations to be conducted at the site. The specific rationale for each sample site is provided in table 4-1. The sampling points are provided on Figures 1 and 2.

It should be noted that the sample locations and types were slightly modified due to the conditions observed during the first quarterly sampling. For example, three additional groundwater sampling points have been added to evaluate the contamination potentially present in the Lonfit River alluvial system. These points represent samples collected from existing monitoring wells in the vicinity of the landfill, which were installed by the Water and Energy Research Institute (WERI) under a Guam EPA contract. In addition, an additional municipal well was included in order to provide additional data on the groundwater quality in the vicinity of the landfill. Finally, some of the leachate discharge points observed during a previous reconaissance of the site were not flowing during the initial sampling round. Therefore, some of these sample locations have been dropped from the monitoring program. The analysis to be performed for each sample is discussed in Section V.

TABLE 4-1

RATIONALE FOR SAMPLING LOCATION

Sample Location	Sample Number	
GW1[a]	279-GW1-GW-003	Municipal Well A-11 - Determine ground-
GW3[a]	279-GW3-GW-002	Municipal Well A-12 water quality in. landfill vicinity.
GW4[b]	279-GW4-GW-002	WERI Monitoring Well - Determine ground-water quality upgradient of landfill.
GW5[b]	279-GW5-GW-002	WERI Monitoring Wells - Determine ground-
GW6[b]	279-GW5-GW-003	water quality of Lonfit River alluvium.
SW1[b]	279-SW1-SW-002	Determine water quality in Lonfit River upstream of Ordot Landfill.
SW2[b]	279-SW1-SW-003	Determine water quality in Lonfit River downstream of Ordot Landfill.
SW5[b]	279-SW5-SW-002	Determine quality in large spring emanating from south side of landfill.
SW6, 8, 9, 10[b]	279-SW6-SW-001 279-SW8-SW-001 279-SW9-SW-001 279-SW10-SW-002	Determine quality of leachate discharges from various locations along south side of landfill.
SW7[b]	279-SW7-SW-002	Determine quality of leachate pond area located along south slope of landfill.

[a] Refer to Figure 1 for sample locations.

[b] Refer to Figure 2 for sample locations.

US07819

PART V - REQUEST FOR ANALYSES

This section presents request for analysis. All of the samples will be analyzed by the Contract Laboratory Program (CLP). It is anticipated that 19 Routine Analytical Service (RAS) water samples will be collected during the second quarter of sampling. These include the following:

- Four (4) leachate stream samples around the landfill (locations SW-6, SW-8, SW-9, and SW-10; Figure 2) .
- Two (2) surface water samples from the Lonfit River (locations SW-1 and SW-2; Figure 2).
- One (1) spring sample (location SW-5; Figure 2).
- One (1) leachate pond sample (location SW-7; Figure 2).
- Two (2) groundwater samples from muncipal wells located in vicinity of landfill (location GW-1 and GW-3; Figure 1).
- One (1) groundwater sample directly upgradient of landfill (GW-4; Figure 2).
- Two (2) groundwater samples from Lonfit River alluvium (GW-5 and GW-6; Figure 2).
- Three duplicates including (1) one groundwater sample (GW-6), (2) one surface water sample (SW-2), and (3) one leachate sample (SW-10).
- Three travel blanks, one for each day of anticipated sample shipment.

Each sample will be analyzed for Target Compound List (TCL) volatile, (semi-volatile, pesticide and PCB) and metal parameters under the RAS program.

Table 5-1 provides a summary of the request for analysis, including sample bottles, preservatives, etc.

TABLE 5.1 SUMMARY OF ANALYSES REQUESTED

CLP ANALYSES REQUESTED matrix = water				ROUTINE ANALYTICAL SERVICES (RAS)			
CHEMISTRY TYPE				ORGANICS		INORGANICS	
SPECIFIC ANALYSES REQUESTED				TCL VOLATILES	TCL EXTRACTABLES	1 TCL METALS	
PRESERVATIVES				Add 2 drops 1:1 HCl Chill to 4 C	Chill to 4 C	Filter, add HNO3 to pH <2 Chill to 4 C	
ANALYTICAL HOLDING TIME (s)				Hold < 14 days	Hold <7 days before ext. 40 days after ext.	Hold < 6 months, (28 days for Hg)	
SAMPLE BY SAMPLE				NO. OF BOTTLES PER ANALYSIS	NO. OF BOTTLES PER ANALYSIS	NO. OF BOTTLES PER ANALYSIS	BOTTLES PER LOCATION
2 SAMPLE NUMBER	SAMPLING SCHEDULE	CONCENTRATION LOW	CONCENTRATION MED.	2 x 40 ml glass vials	4 x 1 Liter amber glass bottles	1 x 1 Liter polyethylene bottle	
279-GW1-GW-003	day 1	x		2	4	1	7
279-GW3-GW-002	day 1	x		2	4	1	7
279-GW4-GW-002	day 1	x		2	4	1	7
279-GW5-GW-002	day 1	x		2	4	1	7
279-TB-04	day 1	x		2	4	1	7
279-GW6-GW-003	day 2	x		2	4	1	7
279-GW6-GW-004D	day 2	x		2	4	1	7
279-SW1-SW-002	day 2	x		2	4	1	7
279-SW2-SW-002	day 2	x		2	4	1	7
279-SW2-SW-004D	day 2	x		2	4	1	7
279-SW5-SW-002	day 2	x		2	4	1	7
279-TB-05	day 2	x		2	4	1	7
279-SW6-SW-001	day 3	x		2	4	1	7
279-SW7-SW-002	day 3	x		2	4	1	7
279-SW8-SW-001	day 3	x		2	4	1	7
279-SW9-SW-001	day 3	x		2	4	1	7
279-SW10-SW-002	day 3	x		2	4	1	7
279-SW10-SW-003D	day 3	x		2	4	1	7
279-TB-06	day 3	x		2	4	1	7
SAMPLE NUMBER	low conc.	19		19	19	19	133
	med. conc.		0				

1. TCL METALS SAMPLES WILL BE FILTERED AND PRESERVED IN THE FIELD AT THE TIME OF COLLECTION.
2. LETTER DESIGNATIONS FOLLOWING SAMPLE NUMBERS ARE AS FOLLOWS: D = DUPLICATE,

* ONE TRAVEL BLANK SAMPLE (DESIGNATED TB) WILL BE COLLECTED EACH DAY.

PART VI - SAMPLING METHODS AND PROCEDURES

All methods, procedures, and quality assurance/quality control measures previously identified in the approved Final SAP (Document No. 279-RI1-IO-DXFL-1) will be followed during the second quarterly sampling effort.

PART VII - HEALTH AND SAFETY PLAN

PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES
AT UNCONTROLLED HAZARDOUS WASTE SITES (REM II)

U.S. EPA CONTRACT NO. 68-01-6939

HEALTH AND SAFETY PLAN
FOR
PHASE I OF
REMEDIAL INVESTIGATION
FOR
ORDOT LANDFILL, GUAM

EPA Work Assignment No.: 168-9LA7.0
REM II Document No.: 279-WP1-OP-CFVM-2

March, 1986

Approved by: _____ Date: 3-7-86
James A. Goodrich, C.E.G.
Site Manager

Approved by: _____ Date: 3-21-86
David Liu, Ph.D.
REM II Region IX, Health & Safety Supervisor

Approved by: _____ Date: 3/21/86
Thomas O. Baily
Region IX Manager

Approved by: _____ Date: 3-19-86
Martin Mathamel
REM II Health & Safety Manager

Approved by: _____ Date: 20 March 86
David F. Doyle, P.E.
Technical Operations Manager

TABLE OF CONTENTS

1.0 ADMINISTRATIVE INFORMATION

REM II Document Number:	279-WP1-OP-CFVM-2
EPA Contract No.	68-01-6439
Site Name:	Ordot Landfill
Site Location:	Island of Guam
EPA Region:	IX
Site Manager:	James A. Goodrich
Site Safety Coordinator:	To be determined
Regional Safety Supervisor:	David Liu, (415) 945-3000
Date:	25 February 1986

2.0 INTRODUCTION

This plan establishes requirements and provides guidelines for worker safety during implementation of the initial site evaluation of the Ordot landfill. The purpose of this site safety plan is to identify procedures for avoiding personnel exposures to harmful levels of chemical substances known or suspected of being present on the site, for monitoring possible exposure, and for responding to serious exposure or accident.

3.0 SITE INFORMATION

3.1 LOCATION/HISTORY

The Ordot Landfill is located in the central part of Guam, approximately 2.5 miles south of Agana. The landfill has been used since at least the 1930's. It was utilized by both Japanese and United States military occupational forces during World War II. Since the war, the landfill has primarily received municiple wastes. The nature and amount of waste which has entered the site has not been recorded.

3.2 SITE BACKGROUND

Ordot Landfill is located in the central part of Guam, approximately 2.5 miles south of Agana. The landfill has been used since at least the 1930's. It was used by both the Japanese and United States military occupational forces during World War II. Since the war, the landfill has primarily received municipal wastes; but because there are no other major civilian waste disposal sites on the island, it also receives commercial and industrial waste. The nature and amount of waste which has entered the site has not been recorded.

Although the site is located in the volcanic region of Guam, it is immediately adjacent to the limestone area to the north, which is the sole source aquifer for the island. Air photo analysis and slope debris suggest that limestone may underlie the site, but this has not been substantiated. If limestone underlies the site, then leachate from the site may be moving north into the sole source limestone aquifer of northern Guam.

A fault separates the limestone and volcanic provinces in Guam (as shown on Figure 1). A spring discharges near the fault along the northwestern boundary of the site and flows southeast into and beneath the landfill and emerges on the south side of the site, where it flows into the Lonfit River. Flow from this spring varies according to the season.

During the site visit, which was in the wet season, flow was at least 100 gallons per minute. The spring water flowing from beneath the landfill was foaming during the site visit. Leachate, probably derived from rainfall infiltrating through the landfill, flows out of the landfill around its perimeter. As a result, the valley bottom immediately south of the site is in a wetlands condition. Some leachate streams contain gas bubbles and grease, as well as foam. Water quality analyses done by Guam EPA indicate that most heavy metals are present in the leachate. Organics were not evaluated in the records currently available from Guam EPA.

3.3 KNOWN ON-SITE MATERIALS

The materials on site are essentially unknown. The use of the site by both the Japanese and Allied Forces during World War II raises the possibility that the site may contain discarded munitions. The subsequent use of the site as the primary disposal area for most municipal, commercial, and industrial wastes for the island of Guam suggests that potentially toxic materials (waste solvents), insecticides, herbicides etc.) are likely present. It is also reasonable to assume that radioactive materials from hospital or industrial sources would have found there way into the Ordot landfill.

Because of the tropical climate at the site and from field observations of gas bubbles in the leachate streams, it is reasonable to assume that a considerable amount of methane is being produced. The complaints of strong odors from rotting garbage and the need for odor masks to approach the site indicate that volatile sulfur compounds are being produced and emitted.

The tropics can offer a number of unique bacterial and fungal organisms that may represent hazard to "unacclimated" workers at the site. Whether this will represent a problem at the Ordot landfill is currently

unknown. Likewise, it is uncertain if the flora or fauna near the site will present any undo risks should more extensive site investigations be initiated.

3.4 WORK DESCRIPTION

Three field activities will be performed during the Initial Site Evaluation program. First, an Initial Site Characterization will be performed according to Section 5.0 of the REM II Health and Safety Assurance Manual (Appendix A). Second, a station will be established on site to monitor gases on the landfill. Third, ten (10) leachate samples will be collected around the periphery of the site, as shown in Figure 1. Two surface water samples will be collected in the Lonfit River; one will be collected upstream and one downstream of the landfill (Figure 1). A water sample will also be collected at Well No. A-11 near Washington Junior High School (Figure 1). The samples will be shipped to a CLP laboratory in California for analysis of Priority Pollutants.

During the third activity, a Caterpillar tractor operating at the site will be used to clear vegetation at selected locations around the site to expose unweathered bedrock (Figure 1). The nature of the bedrock (limestone or volcanics) will be determined. If the two rock types are in contact in the excavation, then the nature of the contact (depositional or fault) will be determined. Other appropriate geologic features in the exposed bedrock will also be noted.

4.0 HAZARD ASSESSMENT

4.1 INHALATION HAZARD

There has been no reported monitoring of air contaminants at the Ordot Landfill. It is logical to assume that methane and some sulfur compounds will be present. Methane is a colorless, odorless, non-

poisonous gas. It has a lower explosive limit of 5.3% and an upper explosive limit of 14%. Although methane itself is not expected to represent a hazard during the ISE, it may serve as a carrier gas for other more toxic volatiles present on site. The amounts of methane produced is unknown. However, they are likely to be high thus facilitating the migration of other materials to the surface. Thus, there is a need to monitor for the presence of those "other" unknowns.

Most of the sulfur containing compounds found in landfills have strong odor properties that prevent toxic exposures from occuring. They are typically so nasally irritating that individuals can not stand to be in the exposure areas long enough to allow the inhalation of toxic quantities. Hydrogen sulfide is a notable exception to this generalization. Hydrogen sulfide is a toxic gas with limited odor warning properties. While it is not expected to be a problem during the ISE, there is a need to monitor for its presence.

4.2 DERMAL EXPOSURE HAZARD

The concentration of chemicals in the leachate or the subsurface soils of the site are unknown. For this reason protective gloves should be worn to prevent direct skin contact with landfill wastes or liquids.

5.0 HEALTH AND SAFETY DIRECTIVES

5.1 PERSONNEL CLEARANCES

All personnel must obtain the equivalent of REM II health and safety clearances before commencing on-site work. The ISE plan does encompass on-site activity where Level C protection will be required.

5.2 SAFETY ORIENTATION

Each employee must receive a safety orientation before beginning his/her field assignment. For the ISE this will consist of receiving and reviewing a copy of Site Safety Plan and acknowledging the review by signature.

5.3 PERSONAL PROTECTIVE EQUIPMENT

It is required that personnel involved in Initial Site Characterization wear steel-toed rubber boots with latex overboots, and tyvek coveralls. Neoprene or butyl rubber gloves must be worn over the latex surgical gloves if there is planned contact with surface or leachate from the landfill. MSA Ultra-Twin full-face air purifying respirator with GMC-H combination cartridges must be carried during the Initial Site Characterization so that they may be donned if instrument action levels are exceeded. The same equipment will be required for the on-site air sampling effort (Task 2) unless the Initial Site Characterization indicates that air purifying respirators do not provide sufficient protection.

It is recommended that personnel involved in off-site activities wear a long-sleeved shirt, long pants, steel-toed boots, and a hard hat where necessary. Neoprene or butyl rubber gloves must be worn during the collection of leachate samples. An odor mask can be used to attempt to alleviate the odors emanating for the landfill.

5.4 DECONTAMINATION PROCEDURES

A decontamination procedure (Alconox boot wash, glove wash and instrument decon) must be set up prior to site entry. This will be the responsibility of the Site Evaluation Team. Decontamination will be necessary for both the Initial Site Characterization and the gas monitoring activities of Task 2. It is important to emphasize that wash

water, used Tyvek, etc. must remain on site. For off-site collecting of leachate samples, the rubber gloves should be washed and rinsed with soap and fresh water prior to removal.

5.5 GAS MONITORING

5.51 On-Site

The Initial Site Characterization Team will use the following instruments and apply the following action levels:

	Instrument	Action
1.	HNU Model P 101 Photoionization Meter with 11.7 probe (or equivalent)	1 ppm above background in breathing zone - respirator protection required. Over 5 ppm above background breathing zone - site/area evacuation
2.	Gastech Model 1314 Hydrocarbon Surveyor/O_2 Monitor (or equivalent)	20% of LEL - Site/area 20.0%/O_2 - Site/area evacuation
3.	Century Systems OVA Model 128 Organic Vapor Analyzer	Methane sensitive - no action level. Used as check on other instruments and to discriminate methane
4.	Ludlum Model 3 Radiation Survey Meter	3 times background at ground level - site/area evacuation not to exceed 2mREM/hr
5.	Monitox Passive Alarm for: H_2S HCN	10 ppm - site/area evacuation 10 ppm - site/area evacuation

US07832

The HNU (or equivalent) and the same action levels as above will be applied to the gas monitoring activities of Task 2.

An Organic Vapor Meter or HNU should be used to record and assess air borne organics on the perimeter of the site. The HNU has a photoionization detection system which is not sensitive to methane. However, the level of organics in the air should be monitored when collecting leachate from the streams eminating from the site. If readings exceed five ppm above background the area should be evacuated and samples taken further down stream.

5.6 SITE EVACUATION PLAN

It will be the task of the Initial Site Characterization Team to develop a plan for site evacuation prior to the commencement of work. This evacuation procedure must be approved by David Liu RHSS before work can begin.

5.7 HEAT STRESS MONITORING

Work in the tropics brings with it the potential problems of heat stress. Although the work planned is not considered strenuous, it will be the decision of the Site Evaluation Team whether heat stress monitoring should be initiated (see Appendix B).

5.8 TIME ON-SITE MONITORING

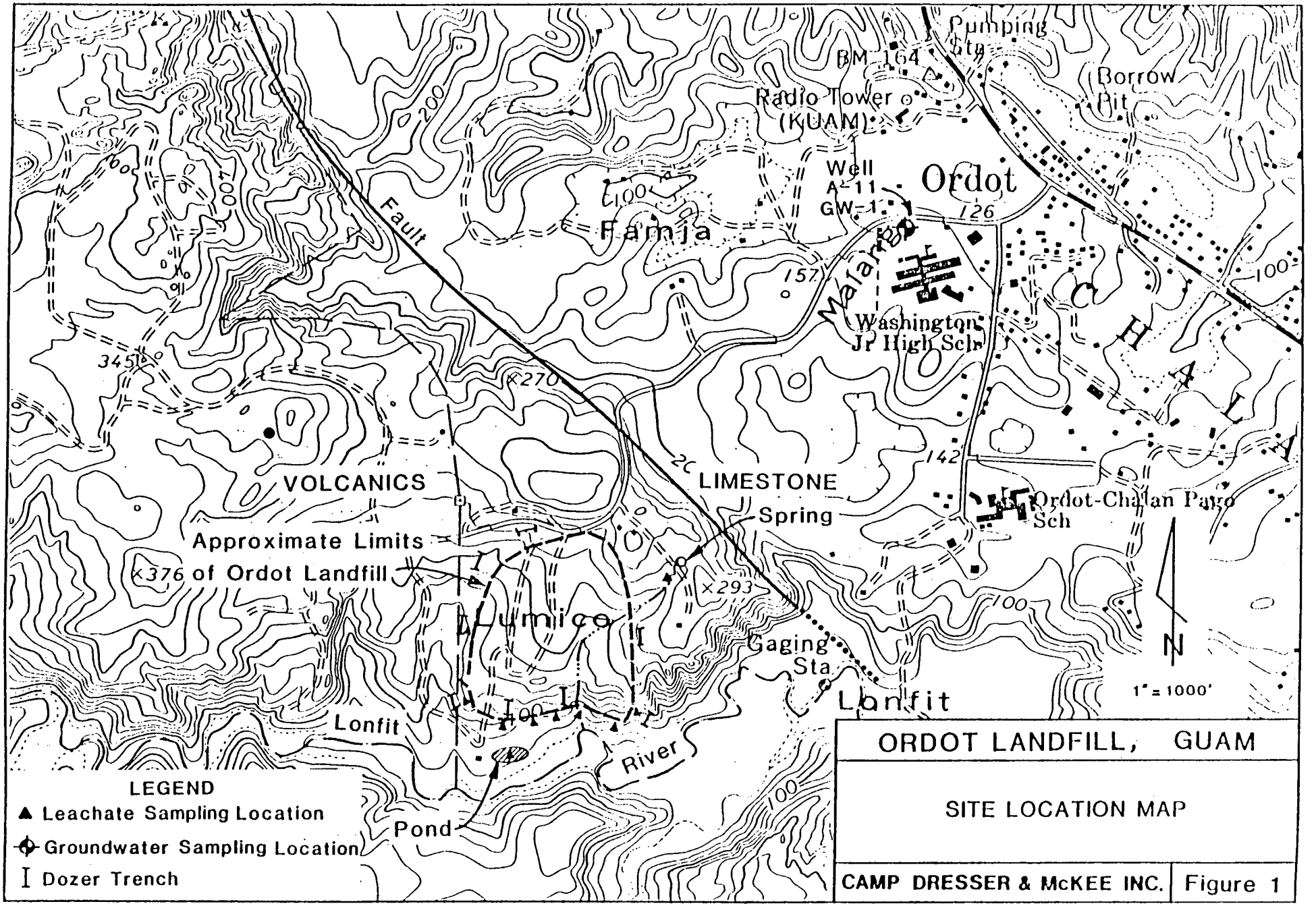
Monthly exposure inquiry forms must be collected and sent to RHSS the first week of each month.

6.0 EMERGENCY RESPONSE RESOURCES

This is a remote site and at present no emergency number is available. The individuals involved in this effort must gather and record appropriate emergency information prior to site entry. The response information must be approved by RHSS (David Liu) before work can begin.

7.0 APPROVALS AND DISTRIBUTION OF HEALTH AND SAFETY PLAN

Martin Mathamel REM II H/S Manager	MS Mathamel	3-19-86
James Goodrich Site Manager	James Goodrich	3-7-86
David Liu REM II Region 9	David Liu	3/6/86


Pumping Sta
BM 164
Borrow Pit
Radio Tower (KUAM)
Well A-11
GW-1
Ordot
Fault
Famja
126
157
Malaka
Washington Jr High Sch
CHALAN
100
345
270
142
VOLCANICS
LIMESTONE
Spring
Ordot-Chalan Pago Sch
Approximate Limits
376 of Ordot Landfill
293
Umiyo
Gaging Sta
Lonfit
Lonfit River
Pond
N
1" = 1000'
LEGEND
▲ Leachate Sampling Location
Groundwater Sampling Location
I Dozer Trench
ORDOT LANDFILL, GUAM
SITE LOCATION MAP
CAMP DRESSER & McKEE INC.
Figure 1

US07836

SITE PERSONNEL PROTECTION & SAFETY EVALUATION FORM

EPA WA NO. 9 REM II DOC. NO. 279-WP1-OP-CFVM-2

SITE: ORDOT LANDFILL EPA REGION: 9

LOCATION: GUAM EVALUATOR: Harry Skalsky - WCC Santa Ana

SITE DESCRIPTION: Ordot Landfill is located in the central part of Guam, approximately 2.5 miles south of Agana. The landfill has been used since, at least, the 1930s. It was used by both the Japanese and United States military occupational forces during World War II. Since the war, the landfill has primarily received municipal wastes, but because there are no other major civilian waste disposal sites on the island, it also currently receives commercial and industrial waste.

SITE CATEGORY (1-5) 3

SITE MAPS ATTACHED: Figure 1 - Location Map

BACKGROUND ENVIRONMENT: To be determined during Initial Site Characterization

AIR

SURFACE WATER

SOIL

GROUNDWATER

ADDITIONAL HAZARDS ON-SITE

INFORMATIONAL SOURCES USED Revised Work Plan Memo 279-WP1-WM-BKD-3

SITE PERSONNEL PROTECTION & SAFETY EVALUATION FORM

REM II DOC. NO. 279-WP1-OP-CFVM-2

FIELD INVESTIGATION ACTIVITIES COVERED UNDER THIS SEF

POP DOCUMENT CONTROL NO. _____

TASK NO.	ACTIVITY	DESCRIPTION	PRELIMINARY SCHEDULE
1	A	Initial Site Characterization	Not yet determined
2	B	Monitoring of Landfill Gases	" " "
3	C	Collection of Leachate and Geologic Investigations Off-Site	" " "

US07838

SITE PERSONNEL PROTECTION & SAFETY EVALUATION FORM

REM II DOC. NO. 279-WPI-OP-CFVM-2

CONTAMINANTS OF CONCERN To be determined

CONTAMINANT	GUIDELINE SHEET ATTACHED	TLV/PEL	SOURCE/QUANTITY CHARACTERISTICS	ROUTE OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE	RESPONSE P.I.D.	RESPONSE F.I.D.	RESPONSE OTHER

US07839

SITE PERSONNEL PROTECTION & SAFETY EVALUATION FORM

REM II DOC. NO. 279-WP1-OP-CFVM-2

SITE PERSONNEL/EQUIPMENT SITE ACTIVITY A & B Initial site characterization and gas monitoring

PERSONNEL

NAME	S.S. NO.	FIRM	REGION	LEVEL OF PROTECTION	CONTINGENCY	VERIFY
Mark Kutchenreiter	181 44 5543	CDM	8	C	Site Exit	( )
Kevin Kelly	564 96 2954	CDM	8	C	Site Exit	( )
James Goodrich	546 82 7460	CDM	9	C	Site Exit	( )
Wayne Berman	151 40 8257	Clements	9	C	Site Exit	( )
						( )
						( )
						( )
						( )
						( )

PERSONNEL PROTECTIVE EQUIPMENT	VERIFY
FF Respirator (Ultra-Twin with GMC-H Combination Cartridge	( )
Tyvek Coveralls	( )
Steel toe/shank neoprene or butyl rubber boots with Latex overboots	( )
Butyl/neoprene gloves over Latex "surgical" gloves	( )
Hard hat	( )
	( )
	( )
	( )
	( )

FIELD MONITORING EQUIPMENT	VERIFY
Foxboro-Organic Vapor Analyzer	( )
HNu Model P 101 Photoionization Meter with 11.7 probe (or equivalent)	( )
	( )
Gastech Model (1314 hydrocarbon surveyor/ 0_2 Monitor (or equivalent)	( )
	( )
Ludlum Model 3 radiation survey meter (or equivalent)	( )
	( )
Monitox Passive Alarm (or equivalent) for HCN and H_2S	( )

DECON: Wash boots & respirator face piece w/detergent, rinse well & dry. Discard clothes and

HS 13.1d

US07840

SITE PERSONNEL PROTECTION & SAFETY EVALUATION FORM

REM II DOC. NO. 279-WP1-OP-CFVM-2

SITE PERSONNEL/EQUIPMENT — SITE ACTIVITY C — Off-Site Leachate Collection

PERSONNEL

NAME	S.S. NO.	FIRM	REGION	LEVEL OF PROTECTION	CONTINGENCY	VERIFY
James Goodrich	546 82 7460	CDM	9	D	Site Exit	( )
Mark Kutchenreiter	181 44 5543	CDM	8	D	Site Exit	( )
Keven Kelly	564 96 2959	CDM	8	D	Site Exit	( )
Wayne Berman	101 40 8257	Clements	9	D	Site Exit	( )
						( )
						( )
						( )
						( )
						( )

PERSONNEL PROTECTIVE EQUIPMENT	VERIFY
Steel toe/shank neoprene or butyl rubber boots and gloves.	( )
	( )
Hard hat	( )
	( )
	( )
	( )
	( )
	( )

FIELD MONITORING EQUIPMENT	VERIFY
HNu Model 101 Photoionization Meter with 11.7 probe (or equivalent)	( )
	( )
Monitox Passive Alarm (or equivalent) for HCN and H_2S	( )
	( )
	( )
	( )
	( )
	( )

DECON:

HS 13.1d

US07841

CONTINGENCY CONTACTS

AGENCY	CONTACT	PHONE NO.	AGENCY	CONTACT	PHONE NO.
• FIRE DEPARTMENT	D.O. Sinajana Fire St.	472-6342	STATE POLICE	N.A.	
POLICE DEPARTMENT	D.O. Agana Central	472-8911	F.A.A.	Juan Taisague	355-5026
HEALTH DEPARTMENT	Vicente Quitoriano	734-2671	CIVIL DEFENSE	Joe Alverez	477-9841
• POISON CONTROL CENTER	E.R. Navy Reg. Med Center	344-9232	• ON SITE COORDINATOR	Kevin Kelly	646-8863
• STATE ENVIRONMENTAL AGENCY	James Canto	646-8863	• 24 HR. HOTLINE FOR TREATMENT OF TOXIC EXPOSURE (513) 421-3063		
• EPA REGIONAL OFFICE	Thomas Mix	(415) 974-8150			
• EPA ERT, ICOM	NOT AVAILABLE				
• STATE SPILL CONTRACTOR	A.C. Limpiaco, Inc.	472-8705			

• DENOTES REQUIRED INFORMATION

MEDICAL EMERGENCY

NAME OF HOSPITAL Navy Regional Medical Center ADDRESS Agana Heights PHONE NO. 344-9232

NAME OF CONTACT Doctor on Duty-Emerg. Room ADDRESS " " PHONE NO. 344-9232

MAP OR ROUTE TO HOSPITAL: See Figure 2, Emergency Route Map

TRAVEL TIME FROM SITE (MINUTES) 5-10 DISTANCE TO HOSPITAL (MILES) 2 NAME OF 24 HR. AMBULANCE SERVICE Tamuning Fire Station 646-8801

US07842

SITE PERSONNEL PROTECTION & SAFETY EVALUATION FORM

REM II DOC. NO. 279-WP1-OP-CFVM-2

SEF REVIEW — I have read, understood, and agreed with the information set forth in this Personnel Protection and Safety Evaluation Form (and attachments) for activities listed on page 2.

Activities covered under this SEF include A B C

S.H.S.C. SIGNATURE _____ DATE _____

R.H.S.S. SIGNATURE David W. H. Lui DATE 3/6/86

COMMENTS: _____

COMMENTS: SHSC must be identified and plan resubmitted for RHSS & HSM review before site work begins. Also, Berman needs to be fit tested.

SITE PERSONNEL

James Goodrich	546-82-7460
Mark Kutchenreiter	181-44-5543
Kevin Kelley	564-96-2959
Wayne Berman	101-40-8257

SITE H & S BRIEFING

CONDUCTED AT CDM's Irvine office

BY H. Skalsky ON before site work begins.

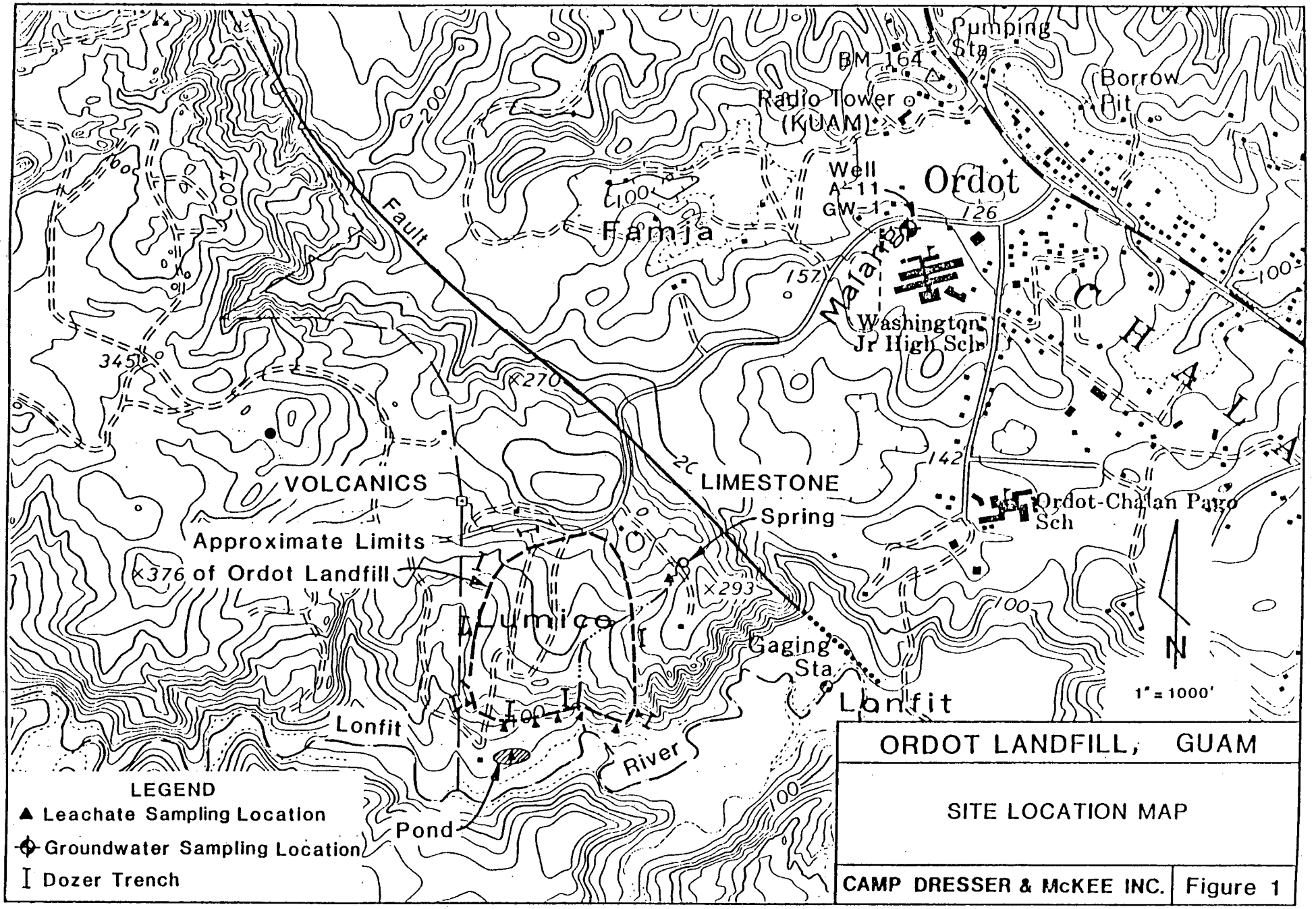
Site safety plan and SEF shall be distributed to site personnel at meeting and discussed. Instrument operator must demonstrate ability to operate instruments properly. ~~Personnel attending meeting must sign Health and Safety~~ Plan Signature Form at end of meeting Dhiu

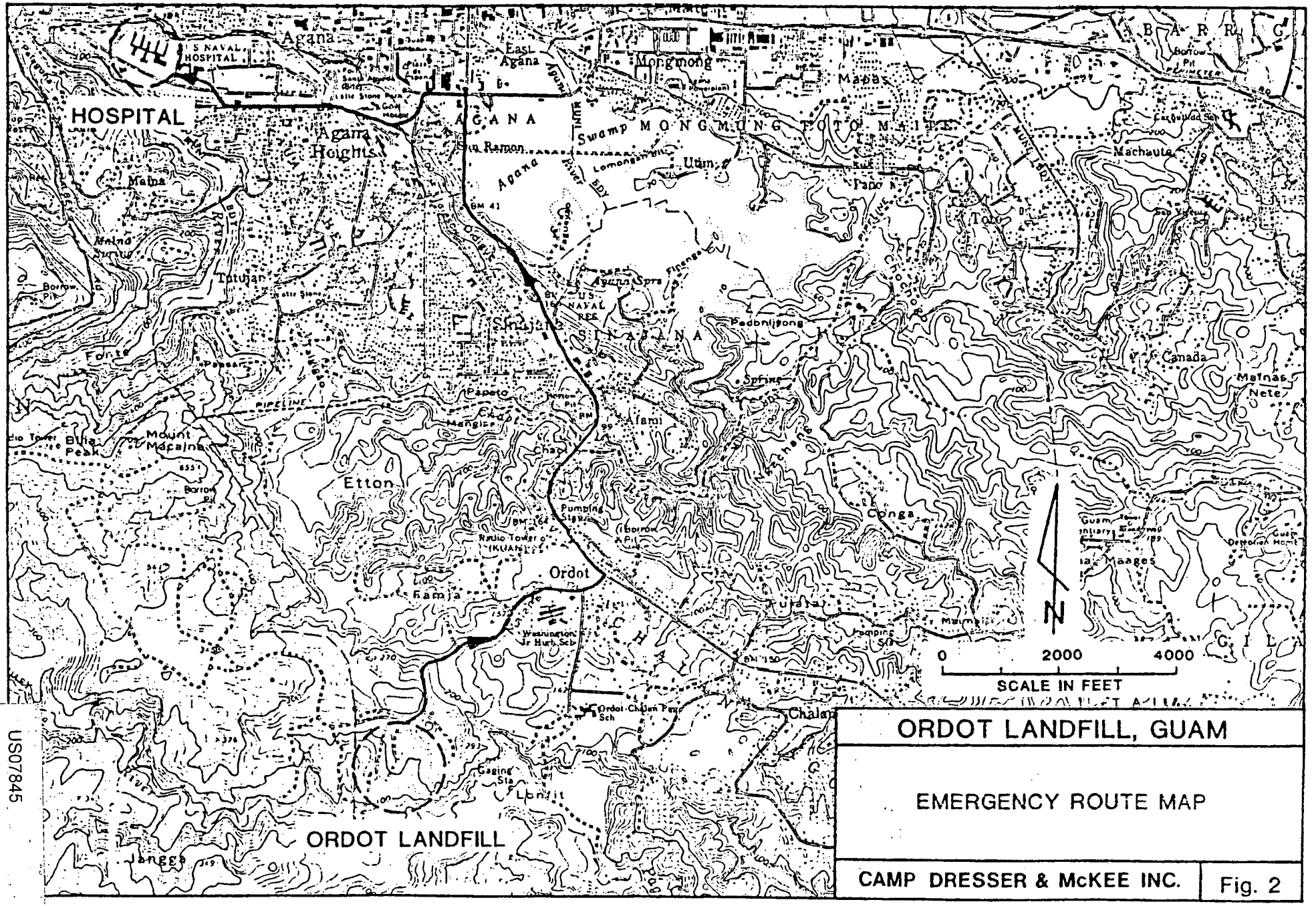
US07843

M S Markham 3-13-86

H.S.M. APPROVAL DATE

REM II H & S INPUT BY _____ DATE _____


Pumping Sta
BM 164
Borrow Pit
Radio Tower (KUAM)
Well A-11 GW-1
Ordot
Famja
Fault
Malaga
Washington Jr High Sch
CHALAN
Ordot-Chalan Pago Sch
VOLCANICS
LIMESTONE
Spring
Approximate Limits of Ordot Landfill
Lumico
Gaging Sta
Lonfit
Lonfit River
Pond
N
1" = 1000'
LEGEND
▲ Leachate Sampling Location
Groundwater Sampling Location
I Dozer Trench
ORDOT LANDFILL, GUAM
SITE LOCATION MAP
CAMP DRESSER & McKEE INC.
Figure 1



ORDOT LANDFILL, GUAM

EMERGENCY ROUTE MAP

CAMP DRESSER & McKEE INC.

Fig. 2

US07845

APPENDIX A

SECTION 16.0 INITIAL AND CONTINUING SITE CHARACTERIZATIONS

16.1 Introduction

This section presents an overview of the procedures to be used during initial and continuing characterizations to develop Health and Safety Plans and to ensure that the existing plan is adequate. More detailed information is included in the *REM II Site Investigations Procedures Manual.*

16.2 Review Of Available Data

Prior to commencement of work at any REM II site, an evaluation of the potential hazards associated with the site shall be undertaken. This evaluation shall consist of a summarization of available data or an actual investigation, depending on the quantity and quality of data available concerning existing site conditions. This evaluation shall be performed by the HSM or the RHSS or available regional staff. Other government contractors. such as the FIT, TAT, etc., shall be contacted to determine if they have been onsite and have performed a site evaluation.

If the information available is insufficient to adequately describe conditions onsite, then an initial site characterization shall be conducted to determine if there is any evidence of oxygen deficiency, explosive hazard, toxic chemical vapors, radiation hazard, or any other conditions at the site that may adversely affect health or safety of field personnel.

16.3 Initial Site Characterization

The objective of an initial site characterization is to evaluate, through the use of direct reading instrumentation, and observation, the presence of conditions which pose potential safety and health hazards to field personnel.

The initial site characterization is undertaken by a survey team generally comprised of the site coordinator, RHSS (or designee), and an experienced instrumentation/site characterization specialist from the regional support staff. The survey team utilizes a variety of direct reading instrumentation to monitor for the presence of organic vapors, respirable dust, total ionizing radiation, and oxygen-deficient/explosive atmospheres. This information is used to develop the HSP. Additional information from the preliminary survey includes the a field survey report plus a site map.

An HSP (approved by the HSM or RHSS) is required for an initial site characterization. Generally, the generic Health and Safety Plan Form (HSP Form) described in Section 15.4 can be used.

The instrumentation used during the initial site characterization usually includes:

- GCA Miniram Respirable Dust Monitor
- HNU Model P 101 Photoionization Meter or equivalent
- GASTECH Model 1314 Hydrocarbon Surveyor/O_2 Monitor

- Century Systems OVA Model 128 Organic Vapor Analyzer
- Ludlum Model 3 Radiation Survey Meter
- Personal Sampling Pumps and Collection Media
- Diffusion Badges
- Colorimetric Detector Tubes
- Monitox Passive Alarm

The survey team prepares for site entry at a staging area upwind of the site which is judged to represent a clean area. This location is used for donning protective equipment, zeroing the instruments, gathering background readings, and preparing for the survey.

The level of protection required for the initial site characterization shall be determined based upon the materials known to be present on-site, or the degree of contamination indicated by sources such as USEPA, or other government contractors, such as the FIT, TAT, etc.

The entire site, including bulk storage vessels, confined spaces, waste lagoons, drum storage areas and other points of interest, is surveyed. Locations where equipment readings exceed background are appropriately recorded for later transcription.

Sufficient data should be obtained during the initial site characterization to determine levels of protection (Sections 11.0 and 12.0), establish site work zones (Section 14.0), and to select candidate areas for more thorough qualitative and quantitative studies. However, monitoring instrumentation should not be the sole criteria for determining levels of protection since these instruments have various limitations and relative sensitivities to chemicals/compounds. Criteria that should be considered when determining levels of protection and health and safety issues for a particular site are, but are not limited to the following:

- Site history especially waste disposal
- Instrumentation readings with consideration for their limitations
- Visual observations, i.e., stained or discolored) soils, dusty conditions, etc.
- Odors

The following sections contain a discussion of how common chemical hazards can be characterized. Refer to Exhibit 16-1 for an overview of some of the characteristics of available monitoring instrumentation, and Exhibit 16-2 for action levels of some common site hazards.

Prior to leaving the site all disposable clothing is removed and placed in the appropriate container, for proper disposal. Rubber boots and other permanent equipment are decontaminated and placed in plastic bags prior to transport from the site.

16.4 Organic Vapors and Gases

If the type(s) of organic substances present at a work site is known and the material is volatile or can become airborne, air measurements for organics should be made with one or more appropriately and properly calibrated survey instruments. When the presence or types of organic vapors/gases are unknown, instruments such as a PID (an HNU PI-101 or equivalent) and/or a portable FID (an OVA-128 or equivalent), operated

in the total hydrocarbon mode, should be used to detect organic vapors. Until specific constituents can be identified, the readout indicates total airborne substances to which the instrument is responding. Identification of the individual vapor/gas constituents permits the instruments to be calibrated and used for more specific analysis. Identification usually requires a personal sampling pump, appropriate collection media, and back-up laboratory analysis. Refer to Sections 11.0 and 12.0 for criteria for developing level of protection based on gross instrument readings. Action levels depend on specific exposure limits such as the TLV, PEL, and IDLH levels. Consult with the RHSS or HSM.

16.5 Inorganic Vapors and Gases

The ability to detect and quantify inorganic vapors and gases is limited. Presently, the HNU PI-101 has limited detection capability while the OVA-128 has none. If specific inorganics are known or suspected to be present, measurements should be made with appropriate instruments, such as a CEA Model TGM 555 Toxic Gas Monitor. Colorimetric Detector tubes are used if the substances present are known and appropriate tubes are available. These tubes are most commonly used for inorganic gases such as H_2S, HCN, phosgene, etc. Also particulate (respirable) dust monitors and personnel monitoring pumps with appropriate media are used, if back-up laboratory analysis is available. Passive monitors, such as the monitox, are valuable for HCN, H_2S, and other gases. Action levels depend on specific exposure limits such as the TLV, PEL, or IDLH. Consult the RHSS or HSM.

16.6 Radiation

Radiation monitoring should be incorporated in all initial site characterizations unless radioactive materials are known as not present.

Normal background gamma radiation is approximately 0.01 to 0.02 millirem per hour (mREM/hr). Background can be significantly higher in some western states, however. Work can continue with elevated radiation exposure rates; however, if the exposure rates increases to 3-5 times above gamma background, a qualified radiation specialist should be consulted. If levels exceed 2 mREM/hr, the area of the site exhibiting the elevated readings shall be evacuated. EPA's Office of Air, Noise, and Radiation has radiation specialists in each Region, as well as at Headquarters, Montgomery, Alabama, and Las Vegas, Nevada. Contact the RHSS or HSM.

The recommended radiation exposure limit for the general public or occasionally exposed individuals is 500 mREM in any one year (National Council on Radiation Protection, 1971). This limit represents the sum of all radiation exposures, including casual exposures and natural background radiation. Current practice is to limit job-related exposures of persons who are not radiation workers to 100 mrem in one year. This translates to an average exposure rate of 50 uREM/hr, assuming a working year of 2,000 hours. Exposure rates can be maintained below this average by controlling the time workers spend in areas of elevated radioactivity.

The absence of gamma readings above background should not be interpreted as the complete absence of radioactivity. Radioactive materials emitting low-energy gamma, alpha, or beta radiation may be present, but for a number of reasons may not cause a response on a survey instrument. Unless airborne, these radioactive materials should

present minimal hazard. but more thorough surveys should be conducted as site operations continue to completely eliminate the possibility of the presence of any radioactive material.

For example, an alpha-emitting radionuclide may be present in a drummed sample. An alpha-survey of the exterior of the drum would not indicate the presence of radioactive material contained in the drum. However, there could be exposure to alpha radiation during drum sampling or other activities.

16.7 Oxygen Deficiency

Ambient air (at sea level) should contain at least 19.5% by volume of oxygen. At lower percentages, air-supplied respiratory protective equipment is needed. Oxygen measurements are of particular importance for work in enclosed spaces, low-lying areas, or in the vicinity of accidents that have produced heavier-than-air vapors, which could displace ambient air. These oxygen-deficient areas are also prime locations for taking further organic vapor and combustible gas measurements, since the air has been displaced by other substances. Oxygen-enriched atmospheres increase the potential for fires.

If the oxygen concentration is less than 19.5%, work should continue using SCBA. If oxygen content is greater than 25% the work should be discontinued because of imminent fire hazard.

It should also be noted that combustible gas readings may be compromised in atmospheres with less than 19.5% oxygen, and that these atmospheres maay pose an explosion hazard.

16.8 Explosivity

Continuous ground, waist and breathing zone measurements shall be obtained in confined areas suspected of containing explosive gases. If readings approach or exceed 10% of the lower explosive limit (LEL), extreme caution should be exercised in continuing the investigation. If readings approach or exceed 25% LEL, personnel should be withdrawn immediately. Before resuming any on-site activities, project personnel in consultation with experts in fire or explosion prevention must develop procedures including engineering controls for continuing operations. Consult with the HSM or RHSS.

16.9 Biologic Hazards

Wastes from hospitals and research facilities may contain disease causing organisms that could infect site personnel. Etiologic agents may be dispersed in the environment via wind water and wind. Other biologic hazards may include poisonous plants, insects, animals, and indigenous pathogens. Protective clothing and respiratory protection reduce the hazard. Thorough washing of any exposed body parts and equipment also reducees the chance of infection.

At present, there is no reliable method for monitoring biologic hazards in the field. The *Biohazards Reference Manual*, American Council of Governmental Industrial Hygienists, 1985, offers a good discussion of biologic hazard control and sampling. Consult the RHSS or HSM.

16.10 Noise

Work around heavy equipment may cause excessive noise exposure. Noise protection may be required if noise levels exceed 90 dBA averaged over an 8-hour day. Noise monitoring may be required if levels exceed 85 dBA averaged over an 8-hour day. Consult the RHSS or HSM.

16.11 Continuing Site Characterization

To verify that site control procedures are preventing the spread of contamination, a monitoring and sampling program should be established based on the initial site characterization. The Support Zone, Contamination Reduction Zone, and Exclusion Zone should be periodically monitored for air contaminants using direct-reading instruments and/or collecting air samples for particulate, gas, or vapor analysis. Analysis of soil samples collected in the most heavily traveled areas would indicate contaminants being carried from the Exclusion Zone by personnel, equipment, or wind. Occasional wipe tests should be taken in trailers and other areas used by personnel. The results of these tests are used to modify the existing Health and Safety Plan.

THIS PAGE INTENTIONALLY LEFT BLANK

EXHIBIT 16-1: Direct Reading Instruments For Site Characterization (continued)

From: *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, 1985.

INSTRUMENT	HAZARD MONITORED	APPLICATION	DETECTION METHOD	LIMITATIONS	EASE OF OPERATION	GENERAL CARE AND MAINTENANCE	TYPICAL OPERATING TIMES
Portable Infrared (IR) Spectrophotometer	Many gases and vapors.	Measures concentration of many gases and vapors in air. Designed to quantify one- or two-component mixtures.	Passes different frequencies of IR through the sample. The frequencies adsorbed are specific for each compound.	In the field, must make repeated passes to achieve reliable results. Requires 115-volt AC power. Not approved for use in a potentially flammable or explosive atmosphere. Interference by water vapor and carbon dioxide. Certain vapors and high moisture may attack the instrument's optics, which must then be replaced.	Requires personnel with extensive experience in IR spectrophotometry.	As specified by manufacturer.	
Ultraviolet (UV) Photoionization Detector (PID)	Many organic and some inorganic gases and vapors.	Detects total concentrations of many organic and some inorganic gases and vapors. Some identification of compounds is possible if more than one probe is used.	Ionizes molecules using UV radiation; produces a current that is proportional to the number of ions.	Does not detect methane. Does not detect a compound if the probe used has a lower energy level than the compound's ionization potential. Response may change when gases are mixed. Other voltage sources may interfere with measurements. Readings can only be reported relative to the calibration standard used. Response is affected by high humidity.	Effective use requires that the operator understand the operating principles and procedures, and be competent in calibrating, reading, and interpreting the instrument.	Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories.	10 hours; 5 hours with strip chart recorder.

US07853

EXHIBIT 16-1: Direct Reading Instruments For Site Characterization (continued)

From: *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, 1985.

INSTRUMENT	HAZARD MONITORED	APPLICATION	DETECTION METHOD	LIMITATIONS	EASE OF OPERATION	GENERAL CARE AND MAINTENANCE	TYPICAL OPERATING TIMES
Direct-Reading Colorimetric Indicator Tube	Specific gases and vapors.	Measures concentrations of specific gases and vapors.	The compound reacts with the indicator chemical in the tube, producing a stain whose length or color change is proportional to the compound's concentration.	The measured concentration of the same compound may vary among different manufacturers' tubes. Many similar chemicals interfere. Greatest sources of error are (1) how the operator judges stain's end-point, and (2) the tube's limited accuracy. Affected by high humidity.	Minimal operator training and expertise required.	Do *not* use a previously opened tube even if the indicator chemical is not stained. Check pump for leaks before and after use. Refrigerate prior to use to maintain shelf life of about 2 years. Check expiration date of tubes. Calibrate pump volume at least quarterly. Avoid rough handling which may cause channeling.	
Oxygen Meter	Oxygen (O_2).	Measures the percentage of O_2 in air.	Uses an electrochemical sensor to measure the partial pressure of O_2 in the air and converts that reading to O_2 concentration.	Must be calibrated prior to use to compensate for altitude and barometric pressure. Certain gases, especially oxidants such as ozone, can affect readings. Carbon dioxide (CO_2) poisons the detector cell.	Effective use requires that the operator understand the operating principles and procedures.	Replace detector cell according to manufacturer's recommendations. Recharge or replace batteries prior to expiration of the specified interval. If the ambient air is more than 0.5% CO_2, replace or rejuvenate the O_2 detector cell frequently.	8 to 12 hours.

US07854

THIS PAGE INTENTIONALLY LEFT BLANK

EXHIBIT 16-2: Action Levels For Common Atmospheric Hazards[a]

From: *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, 1985.

HAZARD[b]	MONITORING EQUIPMENT[c]	MEASURED LEVEL	ACTION
Explosive atmosphere	Combustible gas indicator	<10% LEL[d]	Continue investigation.
		10%-25% LEL	Continue onsite monitoring with extreme caution as higher levels are encountered.
		>25% LEL	Explosion hazard. Withdraw from area immediately.
Oxygen	Oxygen concentration meter	<19.5%	Monitor wearing self-contained breathing apparatus. NOTE: Combustible gas readings are not valid in atmospheres with <19.5% oxygen.
		19.5%-25%	Continue investigation with caution. Deviation from normal level may be due to the presence of other substances.
		>25%	Fire hazard potential. Discontinue investigation. Consult a fire safety specialist.
Radiation	Radiation survey equipment	≤2 mrem/hr[e,f]	Radiation above background levels (normally 0.01-0.02 mrem/hr)[g] signifies the possible presence of radiation sources. Continue investigation with caution. Perform thorough monitoring. Consult with a health physicist.
		>2 mrem/hr	Potential radiation hazard. Evacuate site. Continue investigation only upon the advice of a health physicist.
Inorganic and organic gases and vapors	Colorimetric tubes Chemical-specific instruments, including halide meter, hydrogen sulfide detector, carbon monoxide monitor, and mercury meter	Depends on chemical	Consult standard reference manuals for air concentration/toxicity data. Action level depends on PEL/REL/TLV.[h]
Organic gases and vapors	Portable photoionizer Organic vapor analyzer 1) Operated in gas chromatography (GC) mode 2) Operated in survey mode	Depends on chemical	Consult standard reference manuals for air concentration/toxicity data. Action level depends on PEL/REL/TLV.[h]

[a]Based on *Standard Operating Guides*. U.S EPA. December, 1984.

[b]These are general classes of hazards. Not all components of these classes can be measured.

[c]Consult manufacturers' literature for use limitations associated with the specific equipment and for the specific substances the equipment can detect. See Tables 7-1 and 7-2 for more complete descriptions.

[d]LEL = lower explosive limit.

[e]mrem/hr = milliroentgen equivalent in man per hour.

[f]Source: U.S. Nuclear Regulatory Commission Rules and Regulations, 10 CFR Chapter 1, Part 20.105.

[g]Source: Sax, I.N. 1979. Dangerous Properties of Industrial Materials. Fifth Edition. p. 167. Van Nostrand Reinhold Company, New York.

[h]PEL = OSHA permissible exposure limit.
REL = NIOSH recommended exposure limit.
TLV = threshold limit value.

APPENDIX B

SECTION 9.0 HEAT AND COLD STRESS

9.1 Introduction

Stress can contribute significantly to accidents or harm workers in other ways.

The term stress denotes the physical (gravity, mechanical force, heat, cold, pathogen, injury) and psychological (fear, anxiety, crises, joy) forces that are experienced by individuals.

The body's response to stress occurs in three stages:

- **Alarm reaction** in which the body recognizes the stressor and the pituitary-adreno-cortical system responds by increasing the heart rate and blood sugar level, decreasing digestive activity and dilating the pupils.
- **Adaptive stage** in which the body repairs effect of stimulation and the stress symptoms disappear.
- **Exhaustion stage** in which the body can no longer adapt to stress and individual may develop emotional disturbances, and cardiovascular and renal diseases.

The most common types of stress that effect REM II field personnel are heat stress and cold stress. Current thinking is that heat and cold stress may be the most serious hazard to workers at wastes sites.

9.2 Heat Stress

Heat stress usually is a result of protective clothing decreasing natural body ventilation, although it may occur at any time work is being performed at elevated temperatures.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal. Because heat stress is one of the most common and potentially serious illnesses that hazardous waste sites, regular monitoring and other preventative measures are vital.

REM II site workers must learn to recognize and treat the various forms of heat stress.

The best approach is preventative heat stress management. In general:

- **Have workers drink 16 ounces of water before beginning work,** such as in the morning or after lunch. Provide disposible, 4 ounce cups, and water that is maintained at 50°- 60° F. Urge workers to drink 1 - 2 of these cups water every 20-minutes, for a total of 1 -2 gallons per day. Provide a cool, preferably air conditioned area for rest breaks. Discourage the use of alcohol in non-working hours, and discourage the intake of coffee during working hours. Monitor for signs of heat stress.
- **Acclimate workers** to site work conditions by slowly increasing workloads, ie., do not begin site work activities with extremely demanding activities.

- **Provide cooling devices** to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear which acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- **Install mobile showers** and/or hose-down facilities to reduce body temperature and cool protective clothing.
- In hot weather, **conduct field activities in the early morning or evening.**
- **Ensure that adequate shelter is available** to protect personnel against heat, as well as cold, rain, snow, etc., which can decrease physical efficiency and increase the probability of both heat and cold stress. If possible, set up the command post in the shade.
- In hot weather, **rotate shifts of workers** wearing impervious clothing.
- **Good hygienic standards must be maintained** by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

9.3 Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of heat regulating mechanisms of the body - the individual's temperature control system that causes sweating stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly.

- **Symptoms:** Red, hot, **dry** skin, although person may have been sweating earlier; nausea; dizziness; confusion; extremely *high* body temperature, rapid respiratory and pulse rate; unconsciousness or coma.
- **Treatment:** Cool the victim quickly. If the body temperature is not brought down fast, permanent brain damage or death will result. Soak the victim in cool but not cold water, sponge the body with cool water, or pour water on the body to reduce the temperature to a safe level (102^{o}F). Observe the victim and obtain medical help. Do not give coffee, tea or alcoholic beverages.

9.4 Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by the loss of fluids from the body. This condition is much less dangerous than heat stroke, but it nonetheless must be treated.

- **Symptoms:** Pale, clammy, moist skin, profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache, may vomit, and may be dizzy.
- **Treatment:** Remove the person to a cool, air conditioned place, loosen

clothing. place in a head-low position. and provide bed rest. Consult physician. especially in severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have patient drink 1 - 2 cups water immediately. and every 20-minutes thereafter, until symptoms subside. Total water consumption should be about 1 - 2 gallons per day.

9.5 Heat Cramps

Heat cramps are caused by perspiration that is not balanced by with adequate fluid intake. Heat cramps are often the first sign of a condition that can lead to heat stroke.

- **Symptoms:** Acute painful spasms of voluntary muscles: e.g.. abdomen and extremities.
- **Treatment:** Remove victim to a cool area and loosen clothing. Have patient drink 1 - 2 cups water immediately. and every 20-minutes thereafter. until symptoms subside. Total water consumption should be 1 - 2 gallons per day. Consult with physician.

9.6 Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and aggravated by chafing clothes. The condition decreases ability to tolerate heat.

- **Symptoms:** Mild red rash. especially in areas of the body in contact with protective gear.
- **Treatment:** Decrease amount of time in protective gear. and provide powder to help absorb mositure and decrease chafing.

9.7 Heat Stress Monitoring and Work Cycle Management

For strenuous field activities that are part of on-going site work activities in hot weather, the following procedures shall be used to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. **These procedures are to be instituted when the temperature exceeds 70°F.**

- **Measure Heart Rate (HR).** Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats/minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats/minute.

- **Measure Body Temperature.** Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99.6° F. If it does, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the OT exceeds 99.6°F at the beginning of the next period, the following work cycle should be further shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6°F.
- **Manage Work/Rest Schedule.** The following work/rest schedule shall be used as a **guideline:**

Adjusted Temperature (°F)	*Active Work Time (min/hr) Using Level B/C Protective Gear*
75 or less	50
80	40
85	30
90	20
95	10
100	0

Calculate the adjusted temperature:

T (adjusted) = T (actual) + (13 x fraction sunshine)

Measure the air temperature with standard thermometer. Estimate fraction of sunshine by judging what percent the sun is out: 100% sunshine = no cloud cover = 1.0; 50% sunshine = 50% cloud cover = 0.5; 0% sunshine = full cloud cover = 0.0).

Reduce or increase the work cycle according to the guidelines under heart rate and body temperature.

9.8 Cold Stress

Persons working outdoors in low temperatures, especially at or below freezing are subject to cold stress. Exposure to extreme cold for a short time causes severe injury to the surface of the body, or results in profound generalized cooling, causing death. Areas of the body which have high surface area-to-volume ratio such as fingers, toes, and ears, are the most susceptible.

Protective clothing generally does not afford protection against cold stress. In many instances, it *increases* susceptability.

Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature.

As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is perspiration soaked.

THIS PAGE INTENTIONALLY LEFT BLANK

9.9 Frostbite

Local injury resulting from cold is included in the generic term frostbite. Frostbite of the extremities can be categorized into:

- **Frost nip or incipent frostbite** is characterized by sudden blanching or whitening of skin.
- **Superficial frostbite** is characterized by skin with a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- **Deep frostbite** is characterized by tissues that are cold, pale, and solid.

To administer first aid for frostbite: Bring the victim indoors and rewarm the areas *quickly* in water that is between 39°C and 41°C (102°F-105°F). Give a warm drink - **not** coffee, tea or alcohol. The victim must not smoke. Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws. Then elevate the injured area and protect it from injury. Do not allow blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep victim warm and **get immediate medical care.**

After thawing, the victim should try to move the injured areas a little, but no more than can be done alone, without help.

Note:

- Do *not* rub the frostbitten part (this may cause gangrene).
- Do *not* use ice, snow, gasoline or anything cold on the frostbitten area.
- Do *not* use heat lamps or hot water bottles to rewarm the part.
- Do *not* place the part near a hot stove.

9.10 Hypothermia

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages:

- Shivering
- Apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F
- Unconsciousness, glassy stare, slow pulse, and slow respiratory rate
- Freezing of the extremities
- Death

As a general rule field activities shall be curtailed if equivalent chill temperature (°F) as defined in Exhibit 9-1 is below zero (0°F) unless the activity is of an emergency nature.

EXHIBIT 9-1: Cooling Power On Exposed Flesh Expressed As An Equivalent Temperature Under Calm Conditions

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In <hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
Trenchfoot and immersion foot may occur at any point on this chart.												

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

SOURCE: ACGIH, Threshold Limit Values for Chemical Substances in the Work Environment for 1984-1985.

US07864

HEALTH AND SAFETY PLAN SIGNATURE FORM

REM II Health and Safety Program

INSTRUCTIONS: Site personnel are required to receive a copy of the final site Health and Safety Plan (HSP), and to read, understand, and agree to the provisions of the plan. The Site Manager is responsible to distribute the HSP to personnel as they are assigned to the site. Personnel are required to sign this form indicating agreement. The original of this form is maintained by the Site Manager, and becomes part of the permanent site project files upon completion of site work. Copies of this form are to be sent to the Regional Health and Safety Supervisor (RHSS) and the Health and Safety Manager (HSM). Updated copies of this form are sent to the RHSS and HSM as additional personnel are assigned to the site.

SITE NAME / NUMBER _____

REGION / LOCATION _____

SITE HEALTH AND SAFETY PLAN DOCUMENT NUMBER _____

I have received a copy, read, understood, and agreed to comply with the provisions of the above referenced site Health and Safety Plan for work activities on this site.

PRINTED NAME	SIGNATURE	DATE

US07865